

FORUM

Indirect leakage leads to a failure of avoided loss biodiversity offsetting

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Summary

1. Biodiversity offsetting has quickly gained political support all around the world. Avoided loss (averted risk) offsetting means compensation for ecological damage via averted loss of anticipated impacts through the removal of threatening processes in compensation areas.
2. Leakage means the phenomenon of environmentally damaging activity relocating elsewhere after being stopped locally by avoided loss offsetting. Indirect leakage means that locally avoided losses displace to other administrative areas or spread around diffusely via market effects.
3. *Synthesis and applications.* Indirect leakage can lead to high net biodiversity loss. It is difficult to measure or prevent, raising doubts about the value of avoided loss offsetting. Market demand for commodities is on the rise, following increasing human population size and per capita consumption, implying that indirect leakage will be a rule rather than an exception. Leakage should be accounted for when determining offset multipliers (ratios) even if multipliers become extremely high.

Key-words: activity shifting, averted risk, biodiversity offsetting, displacement, habitat bank, limited loss offsetting, no net loss, offset ratio, secondary leakage, sustainability

Introduction

Biodiversity offsetting is used to compensate for ecological and environmental damage caused by development activities (BBOP 2013; Bull *et al.* 2013; Gardner *et al.* 2013). It is a conservation tool that may complement traditional conservation measures and is usually only applied as part of a mitigation hierarchy after impact avoidance has first been attempted (Kiesecker *et al.* 2009; Gardner *et al.* 2013). While ground implementation and validation lag behind, policy (governmental and corporate), science, analysis and discussion around offsetting have expanded very rapidly during the past decade (Kiesecker *et al.* 2009; Gardner *et al.* 2013; Hayes 2014). For example, in 2012 France adopted a national offset policy with the objective of no net loss (NNL) of biodiversity, and preferably a net gain for currently threatened biodiversity and ecosystems (Quétiér, Regnery & Levrel 2014). There are two main classes of offset activities, habitat restoration offsets and avoided loss (also known as ‘averted risk’) offsets, of which the latter is the focus of the present article.

In contrast to restoration offsets, which compensate for ecological damage via active restoration of injured habitat

or flora and fauna, avoided loss offsets provide compensation via averted loss of anticipated impacts through the removal of threatening processes in the compensation areas (Gibbons & Lindenmayer 2007; Maron *et al.* 2010, 2012). Avoided deforestation is one example of avoided loss offsets. Avoided loss offsets are criticized because the gains generated are calculated compared to a baseline of ongoing decline and therefore never result in a net gain in the ecological condition of the landscape (International Union for Conservation of Nature: IUCN 2014). Estimates of gains via avoided loss must necessarily rely on uncertain estimation of the probability of biodiversity loss at the offset site in the absence of additional protection, but this probability is not easy to estimate (Maron *et al.* 2010; Bull *et al.* 2014). Furthermore, it has been found that offset policies frequently permit the ‘protection’ of a site as an avoided loss offset, even if loss of the offset site itself would have had to be offset (Maron *et al.* 2012). Sites might also be proposed as offsets even if they are unlikely ever to be developed.

Yet another problem, and the one discussed in this article, is leakage (also known as displacement or activity shifting). In the present context leakage means the phenomenon that environmentally damaging activity stopped by avoided loss offsetting (in the offset site) is not really stopped but relocates elsewhere, either fully or partially.

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Leakage of harmful activities is a well-known problem in protected area design (Ewers & Rodrigues 1998; van Oosterzee, Blignaut & Bradshaw 2012). A recent study about offsetting in the mining industry found that leakage had not been prevented even within the impacted regions (Virah-Sawmy, Ebeling & Taplin 2014).

Leakage has been noted as a problem in carbon offsetting and projects for Reducing Emissions from Deforestation and Forest Degradation (REDD). In well-designed REDD projects, leakage risks have to be systematically evaluated using a causal model framework. The expected amount of leakage is then conservatively deducted from project benefits (Olander & Ebeling 2011). Methodologies to do so have, for instance, been approved for carbon accounting under the Verified Carbon Standard (VCS 2013). Nevertheless, there is a major difference between accounting for leakage of a single-dimensional and relatively easily measurable physical quantity (carbon) compared to a high-dimensional and poorly measurable entity (biodiversity). Even in the case of carbon, the cost and complexity of accounting for leakage and the difficulty of finding direct causal links result in major impediments to project implementation (van Oosterzee, Blignaut & Bradshaw 2012). It has also been observed that carbon offsetting could lead to leakage of threats that primarily impact biodiversity and ecosystem services, not necessarily carbon. For example, in Indonesia the highest carbon forests on peat are known to support lower species diversity and concentrations of threatened species than lowland mineral soil forests (Harrison & Paoli (2012). The question of 'what leaks' is related to the contrast between strong sustainability and weak sustainability (flexibility) in biodiversity offsetting: should compensation be like-for-like or should flexibility be allowed (Moilanen *et al.* 2009)?

Despite such concerns, avoided loss offsetting is clearly recognized as a tool in present offset policies. For example, a recent technical paper about offsets compiled by an IUCN task force says: 'Some, therefore, believe that averted risk offsets should only ever represent part of a biodiversity offset programme' (IUCN (International Union for Conservation of Nature) 2014, p. 25). This seems to imply that according to many avoided loss offsets are fine. The same document also specifies: 'Further, claiming that a site would have been destroyed under the status quo may be inconsistent with an overarching policy where impacts can only proceed if they achieve No Net Loss or Net Gain. This is a key critique of averted risk offsets generally. There is, however, a lack of agreement on whether and in what circumstances averting risk is additional' (IUCN (International Union for Conservation of Nature) 2014, p. 25).

With numerous governments, organizations and large multinational corporations involved, the international cross-sectoral collaboration BBOP (Business and Biodiversity Offsetting Programme) is perhaps the most influential consortium engaging in offsetting activities globally. Looking into the BBOP Standard on Biodiversity Offsets

and its Guidance Notes, we find that they consistently repeat avoided (averted) loss as the second major approach of offsetting (BBOP 2012). Concern about leakage is highly visible: for example the 'Guidance Notes to the Standard on Biodiversity Offsets' document mentions leakage 47 times and clearly states that the likelihood of leakage should be evaluated and accounted for. While this attitude is commendable, leakage is seen in a particular way in these documents. It is seen as highly likely when: (i) 'There is intense pressure to access forests for subsistence hunting', (ii) 'Extremely valuable wildlife or timber resources in the area will be much less available following offset implementation', (iii) 'There is a high local population density and dependence on biodiversity for livelihoods', or (iv) 'The offset site and areas like it provide a significant source of income to local communities or commercial enterprises' (BBOP (Business and Biodiversity Offsets Programme) 2012, p. 65). Leakage is thus seen as a local or regional issue, or perhaps as an activity implemented by one company or within one jurisdiction, which is in contrast to carbon offsetting, in which leakage is primarily seen as a long-distance phenomenon (Olander & Ebeling 2011). This brings us to our present point: indirect (and possibly non-local) leakage is an almost fatal problem for avoided loss offsetting.

Avoided loss offsetting and indirect leakage

A SCHEMATIC ILLUSTRATION OF INDIRECT LEAKAGE

The mechanism by which leakage reduces the value of offsetting is that the damage supposedly saved by the offsetting action shifts elsewhere, thus leading to reduced net benefits. If half of the damage 'saved' by an offsetting action leaks, then the compensation is 50% less than expected.

Figure 1 illustrates leakage in the context of avoided loss offsetting. First, area *A1* will be lost due to development or contamination. Another area (*A2*) with the same owner could be proposed as compensation via avoided loss. The offset area also could be purchased from another owner (*A3*), as in habitat banking. Direct leakage would occur if the owner of the offset area relocates activities elsewhere inside the region (*A4* in Fig. 1). Direct leakage is clearly recognized by the BBOP core documents (BBOP (Business and Biodiversity Offsets Programme) 2012), but indirect leakage is much more difficult to observe and prevent. For example, owner *A* could be a complex multinational corporation; it could compensate the loss of opportunities in *A2* by increasing resource extraction in *A5* in another region/administration, effectively reducing the effectiveness of offsetting. Likewise, owner *B* could relocate activities from *A3* to *A6*. Leakage becomes even less transparent if reduced opportunities in region 1 cause increased market demand in another region/administration, thereby leading to increased resource extraction in area *A7* owned by a completely unrelated owner *C*. The last type of leakage is an example of

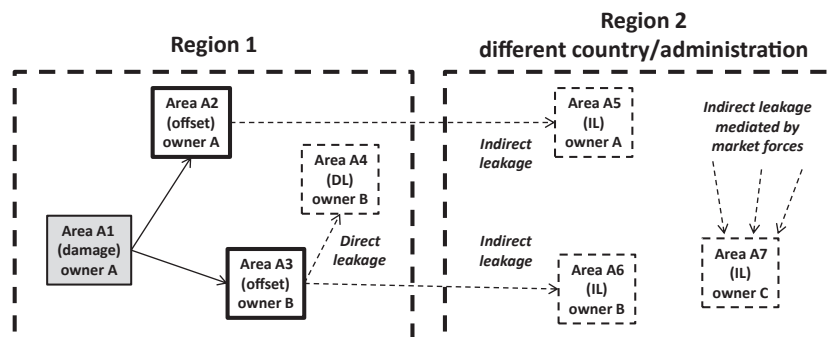


Fig. 1. Schematic illustration of direct (DL) and indirect (IL) leakage. We assume two regions (geographic areas) with different administrations (governments, permitting agencies). In this example, damaging land-use activity and offsetting occur in region 1. In contrast, leakage may relocate impacts within the region or move them to a different administration (region 2). Market forces may mediate indirect leakage via increased demand in areas that are not subject to damage or offsetting. Different owners are indicated for areas.

market leakage and is also called ‘secondary leakage’ while the others represent ‘primary leakage’ mediated by the baseline agents *A* and *B* (Aukland, Costa & Brown 2003). It raises difficult philosophical and operational questions about the implementation of offsetting if leakage is very hard to evaluate or if it is mediated by other parties than those directly involved with damage and compensation.

We have in the example above assumed for simplicity that there would in the absence of offsetting be complete loss of ecological services or biodiversity in the compensation areas. If only partial loss is expected, compensation gains become smaller per unit area, meaning that offset areas need to be proportionally larger to achieve NNL. NNL fails if ‘baseline’ losses prevented by compensation have been overestimated to begin with (Bull *et al.* 2014; Gordon *et al.* 2015).

It is possible to estimate the long-term expected habitat loss when similar offsetting operations occur repeatedly. If complete loss is expected in compensation areas, each damaged area would be adequately (=NNL) compensated by avoided loss in an equal-size compensation area. In the absence of leakage, iteration of this process leads to loss of half of the habitats in the landscape, while the other half becomes protected to compensate for the losses. With complete leakage, two areas are lost for every area designated as offset, implying the loss of two-thirds of the landscape in the long run. Thus, taking a broader perspective, avoided loss offsetting does not result in NNL. At best it only results in limited loss, with the equilibrium state of the landscape depending on the ratio of impacted to compensation areas. Analysis could be applied to avoided loss offsetting to determine the landscape-level loss truly expected.

LEAKAGE-CORRECTED OFFSET MULTIPLIERS

Offset multipliers (or ratios) are operative measures for the amount (area) of offsetting action required in order to achieve NNL (Moilanen *et al.* 2009). Under the very simplified assumption that conservation value is proportional to area, a multiplier can be defined as the ratio of offset area and the impacted area. Multipliers should usually be

much larger than one because of baseline considerations, incomplete restoration effectiveness, relative habitat quality between development and offset site, durations of offsetting actions and the impact, time discounting of losses and/or benefits, and various associated uncertainties (Moilanen *et al.* 2009; Bull *et al.* 2014; Laitila, Moilanen & Pouzols 2014).

The presence of leakage should greatly increase any offset multiplier. First, assume that per-area-unit gain from offsetting equals per-area-unit loss from damage. Then, ignoring leakage, NNL is achieved when the size of the offset area A_O is equal to the size of the damaged area A_D , and the multiplier then becomes $M = A_O/A_D = 1$. Next, let L denote the proportion of averted loss that leaks elsewhere. Then, the amount of damage truly avoided is $(1 - L)$ times A_O , multiplied by the multiplier M . For NNL to hold, compensation must equal damage, implying that $M(1 - L)A_O = A_D$. Given that the sizes of areas were equal, $A_O = A_D$, it follows $M = A_D/[(1 - L)A_O] = A_O/[(1 - L)A_O] = 1/(1 - L)$. More generally, even if the per-area-unit gain and loss are not equal, it is easy to check that any multiplier M should be multiplied by $1/(1 - L)$ to account for leakage, which is a factor independent from other considerations. Consequently, multipliers can become very large: with 90% leakage, the multiplier due to leakage alone would be 10.

FACTORS INFLUENCING DIRECT AND INDIRECT LEAKAGE

From Table 1, it is apparent that (direct) leakage that happens locally is rather different from indirect leakage, which possibly impacts different features than those subject to offsetting, and is possibly mediated by actors not legally involved in the original damage or offsetting.

WHEN COULD AVOIDED LOSS OFFSETS WORK?

Setting aside problems discussed above, cases where avoided loss offsets would appear most useful include the following:

Table 1. Differences between direct and indirect leakage from the perspective of biodiversity offsetting

Influencing factor	Type of leakage	
	Direct	Indirect
<i>Type of resource extracted:</i> renewable (often biotic) vs. non-renewable (often abiotic, or slowly renewing biotic)	Can possibly be controlled for. Permanent reduction in resource use elsewhere in the region could credibly offset losses	Difficult to control. A greater problem with non-renewable resources if indirect leakage is mediated by shifts in global market demand
<i>Organization doing the extraction:</i> local vs. multinational	No major difference locally. Large multinational companies may be better positioned to adopt offsetting policies that require expertise and resources in implementation	Higher risk with multinational companies, which may implement activity shifting to compensate for opportunities lost due to offsetting. Potential for indirect leakage mediated by market effects will also exist
<i>Quality ratio of offset site to damaged area:</i> high vs. low	Can be controlled so that trading like-for-like or trading up is achieved acceptably	Realistic potential for trading down. For example, if offsetting is done in developing countries of relatively low biodiversity importance, economic activity can shift to tropical regions with higher biodiversity
<i>In kind vs. out of kind leakage</i>	Activity shifting away from the offset site could cause impacts to features other than those subject to damage and offsetting. Locally, there may be some possibility to control this	When one commodity becomes sparse it may be replaced with another, causing losses of a different kind. Multinational companies can shift to other types of activities if one becomes limited by offsetting commitments

1. If in the absence of offsetting there will be only damage but no compensation, then perhaps avoided loss offsets are better than nothing, even if damages are incompletely compensated for. This comes with the price of giving legitimacy to development and a potentially flawed process.

2. Offsetting might be fair if the calculation of NNL includes information about the multidimensional character of biodiversity, time delays, leakage and uncertainties, although this may lead to offset multipliers that seem undesirably high from the perspective of developers.

3. Avoided loss offsetting is a possibility when trading up (Gardner *et al.* 2013; Quétiér, Regnery & Levrel 2014), when the lost habitat is of clearly lower ecological importance than the areas saved. While we have not reviewed this, we expect that in many countries offsetting is not required for low or medium quality areas, perhaps making opportunities for trading up rare.

4. Following the previous point, offsetting might work within one country if all activities that influence major habitat types are subject to offsetting, like in the present French policy (Gardner *et al.* 2013; Quétiér, Regnery & Levrel 2014). Nevertheless, this does not remove operational problems nor does it prevent indirect leakage to other countries.

5. Avoided loss offsetting would seem fine if the price paid includes a permanent regional reduction in utilization of natural resources, leading to long-term improvement in the ecological condition of the area. Then again, there will be scarce guarantees against indirect leakage.

Discussion and conclusions

The population of the world and per capita consumption are growing (Lee 2011). This implies that aggregate market demand for commodities is increasing, increasing pressure for the utilization of natural resources, and increasing the likelihood of leakage of environmental damage. Against this backdrop, our expectation is that indirect leakage occurs commonly in avoided loss offset agreements. Concern about indirect leakage comes on top of other serious concerns expressed recently about the response of the society to offsetting. Gordon *et al.* (2015) found that offsetting both via restoration and avoided loss can result in incentives for entrenching or exacerbating baseline biodiversity declines, winding back of non-offset conservation actions, crowding out of conservation volunteerism, and false public confidence in environmental outcomes due to marketing claims that offset actions result in gains. It is a concern if promotion of offsets allows for the higher steps in the mitigation hierarchy to be ignored. Nevertheless, offsetting can provide a better outcome locally compared to doing nothing, and, assuming flexibility is allowed, it could potentially provide funds for other appropriate conservation interventions. Adopting integrated landscape-level approaches to land-use planning, including conservation and offsetting, may reduce the risks of avoided loss offsetting (Hayes 2014). Furthermore, spatial prioritization techniques may be utilized to target offsets in an ecologically well-informed manner (Moilanen 2013).

Avoided loss offsetting is partially at odds with the international targets of the United Nations Convention on Biological Diversity (CBD; IUCN/UNEP (2010)). This is because the CBD 2010 target #11 already implies significant additional protection of habitats by expanding terrestrial protected areas to 17% of land cover. Thereby many of the 'at-risk' areas used as compensation in avoided loss offsetting should actually first become protected following the CBD, meaning that they should not be used for offsetting at all: offsets should always be additional to other conservation action. Secondly, the CBD target #15 says that 15% of the world's degraded ecosystems should be restored, which implies that target #11 should not be made void by corresponding habitat loss elsewhere. As with protected area network expansion, offsetting implemented via habitat restoration should similarly come on top of what should be implemented due to the CBD already. We propose this conceptual argument while being fully aware that the implementation of the CBD resolutions is not really on track to achieving the targets set in 2010 (Tittensor *et al.* 2014).

We have argued that indirect leakage at a spatial scale spanning countries and jurisdictions is a possibly fatal concern with biodiversity offsetting using avoided loss for compensation. Despite avoided loss offsets being quoted as the other major category of offset operations by major organizations concerned with offsetting (BBOP, IUCN, etc.), the present arguments show that: (i) avoided loss offsetting can lead to high biodiversity loss (one-half–two-thirds of the ecological values across administrations), (ii) this loss can be partially alleviated with large multipliers imposed on offsetting, using multipliers in the order of 1/(1-leakage), (iii) there will be great uncertainty about how much leakage is mediated by market demand and multinational companies in any specific case, (iv) indirect leakage could impact biodiversity features not subject to original damage or offsetting (negative externalities; out of kind leakage), (v) the worst combination is avoided loss offsetting implemented by temporary conservation contracts, which leaves no part of the environment safe in the long run, and (vi) unless careful application of avoided loss can be ensured, and leakage can be reliably estimated, avoided loss offsetting should best be avoided. In conclusion, if not carefully applied, avoided loss offsetting much resembles a deceptive marketing ploy. It may perhaps work temporarily for individual projects within one locality, but taking a global long-term view, it could easily lead to compensation gains that fail NNL much worse than expected.

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Data accessibility

Data have not been archived because this article does not contain data.

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